shape, it is only now becoming possible to construct a corresponding theory for the hyperelliptic functions.

Towards this Dr. Baker, in the first part of his treatise, has made a really valuable contribution. The first chapter contains an extremely clear account of the hyperelliptic integrals, and in particular gives the standard ones in their explicit algebraic form. The corresponding Theta-functions are defined, and their properties investigated; the solution of Jacobi's inversion problem is given in an unusually clear form, and art. 10 contains an instructive discussion of the vanishing of a double Theta-function—perhaps one of the most troublesome points in the whole theory.

Chapter ii. contains the differential equations for the Sigma-functions which are afterwards used to find their expansions. By means of Aronhold's symbolical notation they are expressed in a compact invariantive form; and the way in which they are obtained is an elementary one. At the same time, as the author would probably admit, the process is that of leading up to a known result, and not a heuristic one; this is not said by way of disparagement, because it often happens that tedious methods of discovery are properly replaced by others of a more artificial kind. Dr. Baker, in a note at the end, directs attention to the desirability of re-casting the demonstration so as to make it more strictly analogous to the method used for the elliptic Sigma-function.

Chapter iii. deals with the properties of Kummer's surface and Weddle's surface in connection with the properties of the hyperelliptic functions. Here the author's powers of dealing with algebraical analysis appear to great advantage. He has expressed the principal results in a form that is both explicit and elegant; and the English reader who has this book and Hudson's "Kummer's Surface" will be able to attack, if he likes, a very interesting and unusually definite field of research. Chapter v. is of a similar character, and contains, among other things, Mr. Bateman's proof of the differential equation of the asymptotic lines on Weddle's surface, and a geometrical interpretation of the addition theorem. Chapter iv. deals with the expansions of the Sigma-functions, and gives a great number of explicit terms; the invariantive character of the coefficients should be specially noticed.

The second part of the book, "on the reduction of the theory of multiply-periodic functions to the theory of algebraic functions," is of a much more recondite and difficult character. One of its main objects is to prove the theorem that the most general single-valued multiply-periodic meromorphic function is expressible by Theta-functions. The proof given partly depends upon Kronecker's theory of the definition of algebraic constructs (*Gebilde*) by means of systems of equations, partly upon the consideration of a set of "defective" integrals. Dr. Baker is admirably honest, and on p. 207 makes the remark :—"It seems certain that the values of k_{rs} can be taken so that the determinant $[c_{rs}]$ is not zero"; the temptation to make this a positive statement instead of a conjecture would have been considerable to many writers. Whether or not Dr. Baker's proof will stand minute examination in all its parts remains to be seen; it is at any rate an original and very interesting discussion of an extremely difficult and important problem. It is not easy at the present time to foresee what will be the ultimate shape assumed by the general theory of Abelian functions. So far as mathematical rigour is concerned, as well as in its definiteness and attention to detail, the work of Weierstrass is preeminent, and its influence may be continually noted, and is frequently acknowledged in the present treatise. On the other hand, the more intuitive methods of Riemann and his followers are extremely illuminating and fruitful in suggestions and results; while as regards algebraic functions, the method of Dedekind and Weber is very hard to improve upon. One main difficulty, of course, is the increase in the number of independent variables in the associated Theta-functions; to get a "geometrical" field for the variables we must either plunge into unknown spaces or take new elements (*e.g.* straight lines) in our own.

Much light on the general theory and its difficulties is afforded by some special examples which Dr. Baker gives here and there, for instance, on pp. 255–72. In fact, an accumulation of such examples would greatly help beginners to grasp the arguments of the general theory.

In conclusion, attention may be directed to the great economy of space which the author obtains by abbreviated notation for matrices. The only drawback is that matrices are continually denoted by letters of the same type as those indicating quantities. Moreover, double Theta-functions are expressed in the form $\theta(u)$, which stands for $\theta(u_1, u_2)$; consequently, the beginner must be careful to realise the full meaning of the symbols, and he must at once make himself familiar with the elementary theory of matrices. Perhaps, in another edition, matrices might be indicated by letters of a special type. G. B. M.

REINFORCED CONCRETE.

Principles of Reinforced Concrete Construction. By F. E. Turneaure and E. R. Maurer. Pp. viii + 317. (New York: John Wiley and Sons, 1907.)

THIS is the latest text-book on a branch of engineering construction which during the past ten years has developed from its first small beginnings to such an important position that not only is it essential for civil engineers and architects to be familiar with its various applications, but they should also have a sound knowledge of the principles which underlie the design of reinforced concrete structures. The authors have therefore practically divided the book into two sections, the first part dealing with the theory of the subject, the results of tests, and such questions as working stresses and economical proportions, while the second part is devoted to the application of reinforced concrete to building construction, arches, retaining walls, &c.

After discussing fully the properties of the two materials, concrete and steel, both when used independently and when used in combination, the authors proceed to obtain working formulæ for the

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stresses in reinforced concrete beams and columns; in the case of beams of rectangular and T section, flexure formulæ are deduced, based on the assumption of linear variation of the compression of the concrete for working loads; and for rectanglar beams on the assumption of a parabolic variation of this compression for ultimate loads, in both cases neglecting the tension in the concrete; examples are fully worked out to illustrate the use of these formulæ. A considerable amount of lengthy arithmetical work is necessary in using these formulæ, and a series of diagrams has been prepared, published on pp. 213—223, by means of which problems may be solved with rapidity and with a degree of accuracy quite sufficient for all practical purposes. These diagrams are at the end of chapter vi., in which the authors have collected together into a convenient form for reference all formulæ deduced in the earlier chapters of the book. Any engineer or architect who did not wish to check the accuracy of these formulæ or to become familiar with the principles upon which they are based, but merely desired to apply the results directly to some problem of design, would find everything he wanted in a compact form in the forty pages of this chapter.

Since T beams are often continuous over their supports, and since at such points there is a negative bending moment throwing the flange into tension and the lower part of the web into compression, a system of double reinforcement must be adopted in such cases, and this problem is fully worked out, as is also the problem of computing the stresses when the resultant of the external forces acting on the one side of the section of a beam is not parallel to that section. The remainder of chapter iii. is devoted to a discussion on the shearing stresses in reinforced beams, and to the strength of reinforced columns; as the authors point out, in ordinary construction the ratio of length to least width seldom exceeds 15, hence they have dealt with the problem simply as one of short columns.

In chapter iv., the results of a large number of tests of reinforced beams and columns are given, including many tests carried out by the authors themselves; not only are the actual numerical results of these tests of importance, as they afford the only safe test of the accuracy of the formulæ used in their design, but also much valuable information in regard to the design of such reinforced members may be gained from a study of the way in which the final collapse takes place; several plates are given, reproductions of photographs of the fractured beams, which show clearly how the disposition of the reinforcing bars in the beam influences the manner in which it gives way when the destructive load is reached.

In the next chapter the working stresses which can be permitted with this material are fully treated, and such constructive details as the use of steel of high elastic limit, the durability of the material, and its power of resisting the effect of fire. In the last three chapters a number of practical details in reinforced concrete work is given, and the problem of the determination of stresses in arches is dealt with in a very neat and compact fashion. T. H. B.

THE EVOLUTION OF DRESS.

The Heritage of Dress, being Notes on the History and Evolution of Clothes. By W. M. Webb. Pp. xxvi+393. (London: E. Grant Richards, 1907.) Price 15*s*. net.

THERE was certainly room for a scientific account of the evolution of dress. The present book, however, which professes to be "a popular contribution to the natural history of man," is hardly more than a collection of curious survivals in modern fashions, uniforms, the dress of the Court, the Church, the Bar, and other learned and official personages. The bibliography consists largely of articles in magazines and newspapers, and the author seems to have little acquaintance with the scientific literature of the subject, such as the frescoes of the Minoan Age unearthed by Mr. A. J. Evans; the contributions of Mr H. Balfour, Mr. Skeat, Dr. Westermarck, and Dr. Haddon on the evolution of ornament; Prof. Ridgeway on the penannular brooch; Dr. J. G. Frazer's classical paper on mourning as a disguise to baffle the ghost. He appears not to have read even such popular works as those of the late Mr. Elworthy on the "Evil Eye" and "Horns of Honour."

But if Mr. Webb has not written a scientific treatise on the "Heritage of Dress," he has given us, within its limits, an interesting and suggestive book, provided with excellent drawings which really illustrate the many topics with which he attempts to deal, and with an index which, if not quite accurate, is still sufficiently comprehensive. His aim is to furnish a record of survivals, and perhaps in no department of modern life are these more numerous than in that of dress. It is a fact of much scientific importance in connection with the history of social development that so many details in modern costume which we are inclined to believe capricious or accidental, due to the inventive genius of the tailor or the milliner, are really traceable to primitive forms, and that the perpetual changes of fashions are the result of a process of evolution, advancing on conservative lines, in which the influence of early ideas is apparent.

This can be readily illustrated from the wealth of material supplied by Mr. Webb. Thus perhaps the earliest form of dress is the shawl or wrapper, the fringes of which in the modern examples date back to the most early kind of loom. From this are derived the jacket of the woman as well as the trousers of the man. It is more hazardous to trace the shape of the hat to that of the primitive hut; but the band on our silk hats and "bowlers," now purely ornamental, is almost certainly a relic of the fastening of the original cloth headdress.

The origin of liveries, which represent the costume of the wearers' masters in earlier times, is equally curious. When we come to uniforms, almost all their distinguishing features have a history as survivals. The red coat took its colour from that of the best coat in the days of Charles II., and it has thus naturally descended to the fox-hunter and golfer; the baton of the field-marshal is the box in which he used to carry the orders of his sovereign; the epaulettes of the Imperial Yeoman take us back to chain-mail; the

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